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Legation of the United States.

Santiago, Chile, March 25, 1907.

Honorable Elihu Root,

Secretary of State,

Washington.

Sir:

Referring to my despatch No. 100 of November 28, 1906, I beg to transmit herewith the first part of the report of the Chilean Commission appointed to study the great earthquake of the 16th of August last. Dr. Hans Steffen has prepared this first publication of the finding of the Commissiom.

As has been noted in a former despatch, the Commission was badly handicapped in its investigation by the lack of seismic instruments and of accurate geodetic charts. The instruments nearest Valparaiso was the Milne apparatus located in Pilar, Cordoba, Argentina. A photograph of the record furnished by this instrument is transmitted in the report. The only earthquake machine in all Chile (placed in the Quinta Normal of this city) was rendered useless as the result of the first shock which threw the needle vertically upwards completely disabling the apparatus for a time. The charts at the disposal of the members of the Commission have proved to be widely inaccurate; they indicate incorrectly some of the most important and obvious features of the topography of Chile. So that although interesting reports

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came in relation to an apparent alteration in the line of the coast owing to the earthquake, the final determination of this important point had to be left to a future survey of the region affected: no reliance could be placed upon the charts.

The Commission has been forced to turn their whole attention to a personal inspection of the zone of disturbance and the replies made to circulars issued by the Commission. The circulars containing a number of important questions were addressed to the Intendantes, governors, principals of schools, provincial engineers, marine governors, port captains, foreign consuls in Chile, Chilean consuls and consular agents in Argentine, railway station agents, telegraph operators, commandants of police, light house keepers and others. Of the 2500 circulars that were issued, only 155 attained answers. The Commission on Marine territory and the Office of the Times forwarded in addition to these 137 individual reports to the Commission.

The work of the Commission for the most has been the collecting of data furnished by persons living in the disturbed region. During the visits of the members of the Commission to various parts of the country, particular attention has been paid to the difference noted in the effects produced by the earthquake in regions of different geological formation and to the damage caused to buildings. An attempt has been made to determine the intensity of the shocks and the direction of the earth waves and to classify the results according to some scheme such as that

of Mercalli. It is stated that while the earthquake itself presents to the seismologist nothing absolutely exceptional or unknown to science, certain geomorphological phenomena have been noted and described in the report as being of considerable interest.

The Region of Greatest Disturbance.

In general the city of Valparaiso and its immediate surroundings may be designated as the locality where the earthquake shocks were felt with the maximum force. From this as the center, the terrestrial commotion made itself felt with constantly diminishing intensity to the north as far as Tacna, to the south as far as Ancud, to the west in the Juan Fernandez Islands, and to the east as far as the Atlantic Ocean. In the zone of the maximum disturbance, two distinct shocks were distinguished; one of four or five minutes duration and of great violence, while the other continued for about one minute and, which compared with the first, was of equal if not greater force. Between these periods of continuous violent disturbance, came a clearly marked interval when the earth's surface almost ceased to vibrate. In the territory bordering on the region indicated as the "macroseismic region", the movement was presented to the senses as a "single movement which attracted the attention because of its continuity and extraordinary duration".

Nature and Direction of the Movement.

One of the most difficult problems of the which the Commission had to grapple with was that involving the determination of the direction of the earth waves. In default of the records of scientific instruments, the data secured has been obtained from

the reports made by individuals, and by the determination of the direction which hanging objects, walls, etc., took when dislodged by the movement of the earthquake. The personal equation of necessity has entered largely into the results. Only in the matter of the exact time of the occurence of the quake, has such a great discrepancy in the details of reports for the same localities been noted.

It must be granted, however, that the problem itself is one fraught with peculiar difficulties. Had a large number of instruments been scattered over the field, it is probable that somewhat the same trouble would have been experienced in determining the general direction of the earth waves. The history of earthquakes teaches that the readings of instruments in the same localities have varied from each other enormously. Consequently both the nature of the case itself and the means at the disposal of the Commission would give little hope of reaching a satisfactory conclusion on the point. The map prepared by the Commission displays a great irregularity in the direction of the waves. It has been found, however, that the determination of the direction of the waves is of little help in arriving at a location of the epicentrum.

The geological formation of Chile is of the greatest heterogeneity. The variations of the formation of the earth's crust produce difference in the rate and therefore the direction in which a wave is transmitted. A wave passes more rapidly through a rocky soil than through a softer soil. Consequently secondary

waves sometimes outrun the primary waves when the former are transmitted through rock and the latter through soft or marshy ground. When the transmitting medium varies from point to point as greatly as it does in Chile, the resultant vibrations from a common center develope the highest complexity. It may happen that the secondary waves take a direction quite different from that in which the primary waves are advancing.

For eight degrees of latitude, north and south, and from the sea to the Andes, a vertical movement was distinctly felt. Following this very noteworthy vertical movement, came a circular movement of considerable duration, which, combined with horizontal movements, worked the great disaster. The Commission calls special attention to the point that this vertical movement (which was of such extraordinary length and rapidity as to hurl upwards heavy objects resting on the ground), is one of the most remarkable things brought to light by the investigations of the Commission.

A map attached to the last page of the pamphlet gives a graphic resume of the statistical material collected by the Commission on the direction of the seismic movement.

Intensity.

Dr. Steffen proceeds to discuss the intensity of the earthquake on the basis of the scale of Mercalli. The lines of equal intensity have been marked on the map accompanying this part of the report. It is noted, however, that these isoseismal lines have but an approximate value, because of the insufficiency of

the data upon which the estimate is made. This defect has been averted to before.

As has been the case in other earthquakes, the centers of population situated on sandy soft soil deposits or on marshy ground suffered most severely. Another phenomenon which usually accompanies severe disturbances of the earth's surface is the formation of numerous craterlets out of which clay and water were thrown.

Time of the Earthquake.

No little difficulty has been experienced in reaching a conclusion as to the actual time of the occurrence of the earthquake in various parts of the country. It is stated that the seismic disturbance began in Santiago, Copiapo and Pilar (Argentina) distant from each other 680, 700 and 800 kilometers, respectively, at about the same time, there being less than a minute of difference in the time of the initial manifestation of the movement in these three places. Over a territory of enormous extent, therefore, the shocks were almost simultaneous.

I have the honor to be, Sir,

Your obedient servant,

JOHN HICKS.